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Synopsis of Research topic

"Studies on the Impact of Various Dietary Combinations to Enhance Zooplankton Density"

Submitted for

Registration to Ph.D. Degree in Zoology
under the faculty of Science and technology,
at research centre
Department of Zoology, Shri Shivaji college,Parbhani.

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Abstract of proposed work plan

"Studies on the Impact of Various Dietary Combinations to Enhance Zooplankton Density"

Introduction:

The world plankton refers to the floating organism that lives on surface water. These organisms can be plant or animals. The plant forms are phytoplankton and animal forms are zooplankton. Zooplankton are the heterotrophic type of plankton. These are organisms drifting in the water column of oceans and fresh waterbodies. The word, zooplankton is derived from the Greek zoon, meaning "animal" and planktos, meaning "wanderer" or "drifter".

Many zooplankton are too small to be seen individually with the naked eye. Zooplankton are small animals that float freely in the water column of lakes and oceans and whose distribution is primarily determined by water currents and mixing. Zooplankton play a role of converting phytoplankton in to food, suitable for fish and aquatic animals and acquired importance in fishery research.

Zooplankton has also a strong effect on biomass stocks of other planktonic groups, in fact zooplankton can alter the concentration of prey populations (by consumption) and predator populations (by being consumed), consequently having effects on fish biomass (Vanni, 2002). It confirms, more the zooplankton density in any aquatic habitat, more the fish growth.

Hence an attempt has been made to study the impact of various dietary combinations to enhance zooplankton density. In this context, we will assess monthly variation in water chemistry and quali-quantitative status of zooplankton in Bhogaon reservoir, Ta Jintur Dist Parbhani and compare the zooplankton density of selected water body with the zooplankton density of experimental set up.

Review of Literature and Development in the subject:

(Previous work done in the relevant area)

Modern hydrobiology was developed by Forel (1841–1912). He performed his work on many Swiss lakes. The early fresh water stations produced a wealth of data that laid the foundation for modern ecology. Over the past few decades, thorough research on the limnology of various types of water resources has been conducted. The study covers a variety

of lotic and lentic fresh water ecosystem aspects, including water quality and its physical, chemical, and biological characteristics (phytoplankton, zooplankton, macrophytes, and animals of various taxonomic categories, which have been reviewed and included in numerous research papers, dissertations, theses, monographs, and books (Dube, 2002; Basavarajappa *et al.,* 2014).

All of an aquatic ecosystem's functional components, including food chains, food webs, energy flow, and nutrient cycling, are influenced by zooplankton (Park and Shin, 2007). The diversity of zooplankton adapts quickly to changes in the aquatic environment. As bioindicators, a number of zooplankton species are used (Ahmad *et al.*, 2011, Mola, 2011).

When compared to nearby temporary ponds and permanent ponds studied by Gaikwad *et al.* in 2008, the diversity in the permanent pond was significantly higher (i.e. 19) than the diversity in the temporary ponds (i.e. 8), which were some recently dried water bodies in the north Maharashtra region.

Kedar *et al.* (2008) used physico-chemical parameters to study the seasonal abundance of the zooplankton population in Rishi Lake and found 61 zooplankton there. Zooplankton numbers were highest in the summer and lowest during the rainy season. All indices including pH, DO, alkalinity, total hardness, chlorides, sulphates, nitrates, and phosphates were at their maximum in the summer and their lowest in the rainy season, indicating a close association between physico-chemical variables and zooplankton.

In the Nasik District's temple pond, Tidame and Shinde (2012) conducted research on the diversity of zooplankton. Various zooplankton were observed during the study time, however rotifers are the most prevalent. Total of 17 genera were recovered from rotifers, with Brachionus being the most prevalent and plentiful in both ponds. 21 species of rotifers from 15 genera were found in Amrutkund, and 23 species from 14 genera were found in Ramkund Pond. In both Ram Kund Pond and Amrit Kund Pond, the monsoon season saw the greatest diversity of rotifers. In West Bengal, zooplankton abundance in ponds with various fish farming systems was examined by Banerjee *et al.* (2014).

Pawar (2016) evaluated the seasonal change of the zooplankton diversity of the Majalgaon reservoir in Maharashtra. 23 species were identified throughout the study period, including eight species of Rotifers, six species of Cladocera, five species of copepods, two species of Ostracod, and two species of Protozoa. The amount of zooplankton was highest in the summer and lowest in the winter.

Wasarat and Chauhan (2018) conducted studies on freshwater zooplankton diversity and recorded rotifera as most diversity group in Halali reservoir, Bhopal, Madhya Pradesh.

Babare *et. al.*, (2019) studied the zooplankton diversity of Kurnur dam in Akkalkot and recorded the 16 zooplankton species belonging to four different groups with rotifera as dominant one comprising 43.54% and lowest by Protozoa with 10.22%. Yewale R M (2021) observed the zooplankton diversity in Pentakli lake of Buldana and recorded the existence of 40 species belonging to three groups viz., Rotifera, Copepoda and Cladocera with Rotifera (22sp) as dominant group.

We have not found the work on proposed research problem that is studies on impact of various dietary combinations to enhance zooplankton density.

Objectives of Research / Proposed Hypothesis:

1) To analyze of water parameters from controlled water body.
2) To analyze zooplankton density and diversity of controlled water body.
3) To study the effect of different dietary combinations on zooplankton density.
4) The chemical analysis of selected dietary combinations.
5) Collection identification and validation of certain selected zooplankton culture i.e. Copepoda, rotifers, Cladocera.
6) To suggest most suitable dietary combinations to enhance zooplankton density.

Methodology to be adopted:

Various water parameters viz., temperature, dissolved oxygen, free carbon dioxide, hardness, chlorides, nutrients etc. will collected and estimated on monthly basis by adopting the standard methods given by APHA (1989).

Density of zooplankton of selected waterbody will be estimated by using standard methods given by APHA (1989) whereas identification of zooplankton will be done by adopting keys and monographs given by Edmondson (1959).

As most of the water bodies are dominated by Rotifera, Copepoda and Cladocera, hence, one representative species of mentioned group will be selected to study the different dietary combinations on zooplankton density.

Four dietary combinations namely Baker's yeast (B), Baker's yeast Wheat flour (BW, 1:2), Baker's yeast Chicken flesh (BC, 1:2) and Baker’s yeast, Chicken flesh and Wheat flour (BCW) will be given to selected species Five (Four combinations and one control) different experimental sets for every selected zooplankton species will be set to study the effect of various dietary combinations on zooplankton density on weekly basis.

Importance of study

International Status:

Zooplankton are pivotal in the cycling of carbon and nutrients, regulating climate, supporting primary and secondary production, maintaining biodiversity, food web configurations and balance among trophic levels, and sustaining fisheries production, tourism, and human communities (Keister et al., 2012; Pinkerton et al., 2020). Their central trophic position as grazers and prey means they directly affect biomass, structure of food webs, and modulate ecosystem functioning. In some regions, zooplankton are the major grazers and can influence the amount of production that reaches mid and higher trophic level consumers, including fish, squid, marine mammals, and birds. Through the regeneration of nitrogen, zooplankton enhance phytoplankton production (Richardson, 2008). Processes associated with feeding, vertical migration, and mortality also support microbial production and facilitate the transfer of organic matter to the deep ocean: contributing to benthic communities (Ruhl and Smith, 2004; Schnack-Schiel and Isla, 2005), carbon drawdown, storage and sequestration, dimethyl sulfide production and hence a negative (mitigating) feedback on climate change (Jónasdóttir et al., 2015; Steinberg et al., 2017; Barnes et al., 2018).

National Status:

The era of Global warming, the health of all the ecosystems including aquatic ecosystem has been deteriorated and there is a constant need of monitoring and assessing the quality of water, so that further steps can be taken to control the pollution level and improve the health of ecosystem. Living organisms as bioindicators can be used to assess the level of water pollution Zooplankton as bioindicator can be used to check the pollution level of an aquatic ecosystem. The distribution, abundance and species richness indices can be used to check the trophic state of any lentic or lotic ecosystem. The technique of using living organisms as indicators of pollution is known as biomonitoring. Biomonitoring involves selection of a sensitive biological community which gives immediate signs of slightest impacts caused by pollutant or stressor, knowing about the ecology of selected community and selecting an appropriate sampling method to present whole population (Ramachandra et al., 2006). Eutrophication of lakes causes increase in biomass of zooplankton and replacement of some sensitive species and groups of zooplankton. Zooplankton such as Daphnia sp., Copepods and rotifers used as test organisms ecotoxicologically to assess the impact of pesticides (Suthers and Rissik, 2009).

NITI Ayog 2019 has emphasized that water resources are the vital component of economic growth. The Comprehensive Water Management Index (CWMI) 2019 measures performance of States on the basis of set of water indicators. Himachal is one of the top performers in context to water management and scores with improvement from 4 to 11 points. One of the goals of NITI ayog is to improve piped water supply to rural and urban inhabitant, treatment of waste water. Role of zooplankton as bioindicators can be useful in this context as they can be used to check pollutant level of treated and untreated water. Further, general awareness about aquatic organisms in relation to water quality can be used to tackle many water quality issues and can be combined with the government policies of state government or local government. Biomanipulation can also be used to control the trophic state or pollution level of an aquatic ecosystem. Zooplankton are also being used as ecotoxicological test organisms to check the effects of various toxic substances including pesticides in water. This phenomenon may be used in various pollution management programmes (Suthers and Rissik 2009).

Assessment of zooplankton biodiversity will be useful assess the quality of water and fishery productivity of aquatic ecosystem in future. Studies on the continuous monitoring of local ecosystem will be useful to assess future impact of climate change and global warming on distribution of zooplankton which will be further helpful to formulate the effective conservation strategies. Which further will be useful to give technical report to policy makers to control pollution level. Palaeolimnilogy that is study of plankton can be used to assess the past status of the river ecosystem (Suthers and Rissik, 2009), specially ostracodes are used as palaeoenvironmental indicators (Kadam 2016), these studies can be used to relate the past and present status of an aquatic ecosystem and to assess that how much pollution has been caused. After Biomonitoring the next steps will be biomanipulation and restoration of ecosystem that is return of an ecosystem to a close proximation of its condition prior to disturbance (Ramchandra et al.2006).

Significance of the Study:

Studies on hydrological parameters and diversity and density of zooplankton of selected waterbody i.e., Bhogaon reservoir will help to reveal its status in terms of nutrition and pollution.

The laboratory experiments of the present research proposal may suggest the most suitable dietary combination to enhance zooplankton density which will be helpful to increase the economics of fishery sector and livelihood of fishermen, by increasing the growth of fish.

Year-wise Work plan:

Time Period	Work Plan
Year One (0 to 6 months)	Preparation of Course work examination
Year One (7 to 12 months)	Preparation of synopsis.
Year Two (0 to 6 months)	Review of Literature
Year Two (7 to 12 months)	Set up of Experiments.
Year Three (0 to 6 months)	Data collection from laboratory experiments and selected water body
Year Three (7 to12 months)	Data collection from laboratory experiments and selected water body
Year Four (0 to 6 months)	Data compilation and rearrangement
Year Four (7 to 12 months)	Thesis writing and submission to the University
Year Five (0 to 6 months)	Final Viva-voce

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